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From: Ham-Homebrew Mailing List and Newsgroup <ham-homebrew@ucsd.edu>  
Errors-To: Ham-Homebrew-Errors@UCSD.Edu  
Reply-To: Ham-Homebrew@UCSD.Edu  
Precedence: Bulk  
Subject: Ham-Homebrew Digest V93 #52  
To: Ham-Homebrew

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Today's Topics:

                    sideband filtering

Send Replies or notes for publication to: <Ham-Homebrew@UCSD.Edu>  
Send subscription requests to: <Ham-Homebrew-REQUEST@UCSD.Edu>  
Problems you can't solve otherwise to brian@ucsd.edu.

Archives of past issues of the Ham-Homebrew Digest are available  
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We trust that readers are intelligent enough to realize that all text  
herein consists of personal comments and does not represent the official  
policies or positions of any party. Your mileage may vary. So there.

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Date: 22 Sep 93 02:07:33 GMT  
From: ogicse!emory!kd4nc!ke4zv!gary@network.ucsd.edu  
Subject: sideband filtering  
To: ham-homebrew@ucsd.edu

In article <930921071236@spence> spence\_s\_wilhelm@ccm.hf.intel.com writes:  
>I'm having trouble understanding how superhet recievers filter  
>out one sideband of a CW singnal. Is this filtering done by the  
>IF filter or a function of the BT0? How does the mechanism work?  
>I've read the sections about this in the Handbook and RF Design  
>but neither say much about the subject. Can anyone shed some light  
>on this subject?

Well I'll give it a shot. Let's assume a typical single conversion  
radio with a 9 MHz IF and a desired signal at 14 MHz. To mix the  
14 MHz signal to 9 MHz, we could use a 5 MHz local oscillator, or  
a 23 MHz LO. Let's assume the traditional 5 MHz LO. Ok, so at the  
first mixer we have our desired signal and a bunch of undesired  
signals at other frequencies. One signal, at 4 MHz, is called the  
"image" frequency. The front end must be selective enough not to  
pass this signal to the mixer or it will appear with the desired  
signal at the IF of 9 MHz.

The mixing process produces sum and difference frequencies as well as passing through some of the original frequency energy. So at the output we have a 5 MHz signal, a 14.0 MHz signal, some other signals around 14 MHz, the sum signal of 19 MHz, and a difference signal of 9 MHz. The signals far from 9 MHz will be stripped by the selectivity of the following stage.

Ok, so now we have a group of signals near 9 MHz that were originally near 14 MHz. For instance, our desired signal is exactly at 9 MHz while a signal appearing at 14.1 MHz would now be at 9.1 MHz. If we follow the first mixer with a narrow 9 MHz filter, it will only pass signals very closely around 9 MHz. Say the filter has a bandwidth of 500 Hz, then signals further from 9 MHz than +/- 250 Hz will be attenuated by the filter's characteristic response. So the 9.1 MHz signal, being 100 kHz away from our desired signal, will be attenuated by the filter. That's far enough into the filter's stopband that the signal will be attenuated by at least 60 db. Closer signals will be attenuated less as the filter's slope rises. Signals 250 Hz away will be attenuated 6 db. The shape factor of a filter is the ratio of the 6 db to 60 db response points. A filter with a better shape factor has steeper "skirts". That is, the 6 db and 60 db points are closer together. For "single signal" reception, we want the shape factor to approach 1 as closely as possible.

Now the IF bandpass will be amplified and passed to the second mixer, or detector stage. Here it's mixed again, this time with a LO near 9 MHz, say 8.9993 MHz. The resultants are at an audio frequency of 700 Hz, the difference frequency, and at 9.0007 MHz, the sum frequency. The latter will be stripped by the low pass filter at the beginning of the audio amplifier. The audio amp will now boost our desired signal to the point where we hear it.

Gary

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|-----------------------------|------------------------|--------------------------|
| Gary Coffman KE4ZV          | "If 10% is good enough | gatech!wa4mei!ke4zv!gary |
| Destructive Testing Systems | for Jesus, it's good   | uunet!rsiatl!ke4zv!gary  |
| 534 Shannon Way             | enough for Uncle Sam." | emory!kd4nc!ke4zv!gary   |
| Lawrenceville, GA 30244     | -Ray Stevens           |                          |

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End of Ham-Homebrew Digest V93 #52

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